

1. A method of producing an elemental material of Ti, Al, Sb, Be, B, Ga, Mo, Nb, Ta, Zr, V, Ir, Os, Re and U or an alloy thereof from a halide vapor of the elemental material or mixtures thereof comprising submerging the halide vapor or mixtures thereof in liquid alkali metal or liquid alkaline earth metal or mixtures thereof to convert the halide vapor to elemental material or an alloy.

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2. The method of claim 1, wherein the <sup>liquid</sup>alkali metal is Na, K or mixtures thereof and the <sup>liquid</sup>alkaline earth metal is Mg, Ca, Ba or mixtures thereof.

3. The method of claim 2, wherein the halide vapor is supplied at a pressure sufficient to maintain sonic flow, ~~an inert gas of Ar or He gas is added to the halide vapor~~ and the elemental material produced is maintained at a temperature such that it does not sinter. RPA 1/8/97

4. The method of claim 3, wherein the elemental material is produced in batches.

5. The method of claim 3, wherein the elemental material is produced continuously.

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6. The method of claim 1, wherein the halide vapor is intimately mixed with the <sup>liquid</sup>alkali metal or liquid alkaline earth metal in a zone enclosed by the liquid during formation of the elemental material.

7. The method of claim 1, wherein the temperature of elemental material is at least partly controlled by the quantity of the liquid metal contacting the elemental material during formation thereof.

8. A method of continuously producing a non-metal or a metal or an alloy thereof comprising, providing a supply of halide vapor of the metal or non-metal or mixtures thereof, providing a supply of liquid alkali or alkaline earth metal or mixtures thereof, introducing the halide vapor submerged in the liquid alkali metal or alkaline earth metal or mixtures thereof at a velocity not less than the sonic velocity of the halide vapor to produce a powder of a non-metal or a metal or an alloy thereof and a halide of the alkali or alkaline earth metal by an exothermic reaction, separating the powder from the reactants, separating the alkali metal halide or the alkaline earth metal halide into its constituent parts, cooling and recycling the alkali metal or the alkaline earth metal to react with additional halide vapor.

9. The method of claim 8, wherein the halide vapor is one or more of  $\text{TiCl}_4$ ,  $\text{VCl}_4$ ,  $\text{NbCl}_5$ ,  $\text{MoCl}_4$ ,  $\text{GaCl}_3$ ,  $\text{UF}_6$ ,  $\text{ReF}_6$ .

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10. The method of claim 9, wherein the halide <sup>vapor</sup> is  $\text{TiCl}_4$ , the <sup>liquid</sup> alkali metal is Na and the temperature of the liquid Na away from where the halide vapor is introduced is maintained in the range of from about 200°C to about 400°C.

11. The method of claim 8, and further comprising contacting the halide obtained from separating the alkali metal halide or alkaline earth metal halide into its constituent parts with ore of the elemental metal or alloy.

12. A method of producing Ti powder from a source of  $\text{TiCl}_4$  vapor, comprising introducing the  $\text{TiCl}_4$  vapor submerged in liquid

Na to produce Ti powder and separating the Ti powder from the liquid Na.

13. The method of claim 12, wherein the liquid Na is flowing in a stream.

14. The method of claim 13, wherein <sup>SUBSTANTIALLY ALL OF</sup> the Ti powder has a particle diameter in the range of from about 1 to about 10 microns.

15. The method of claim 13, wherein the  $TiCl_4$  vapor is introduced into the flowing stream of liquid Na by injection.

16. The method of claim 15, wherein the flowing stream of Na is present in excess over the stoichiometric quantity needed to react with the  $TiCl_4$  vapor such that the Ti powder produced does not sinter.

17. The method of claim 12, wherein the liquid Na is present as a batch.

a 18. A method of continuously producing a non-metal or a metal or an alloy thereof comprising, providing a supply of halide vapor of the metal or non-metal or mixtures thereof, providing a supply of liquid alkali <sup>metal</sup> or alkaline earth metal or mixtures thereof, introducing the halide vapor submerged in the liquid alkali metal or alkaline earth metal or mixtures thereof to produce a powder of a non-metal or a metal or an alloy thereof and a halide of the alkali or alkaline earth metal, said alkali or alkaline earth metal being present in sufficient quantities in excess of the stoichiometric quantity necessary to reduce the halide vapor to quench the reaction products below the sintering

temperature of the non-metal or metal or alloy thereof, to capture heat from the reactor, separating the alkali metal halide or the alkaline earth metal halide into its constituent parts, recovering heat from the excess alkali or alkaline earth metal and recycling the alkali metal or the alkaline earth metal to react with additional halide vapor, and using the recovered heat to vaporize liquid halide from the source thereof to produce halide vapor to react with ore of the metal or non-metal.

19. The method of claim 18, wherein the halide is the chloride of one or more of Ti or Zr.

20. The method of claim 19, wherein the alkali or alkaline earth metal is present as a flowing stream and the chloride vapor is introduced by injection thereinto.

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